

# Grid Impacts, Benefits, and Lessons Learned

Key Documents from DOE's Recovery Act Smart Grid Investment Grant and Demonstrations Programs

This document provides a list of key reports and case studies,  
and will be updated periodically as new materials are published and posted on



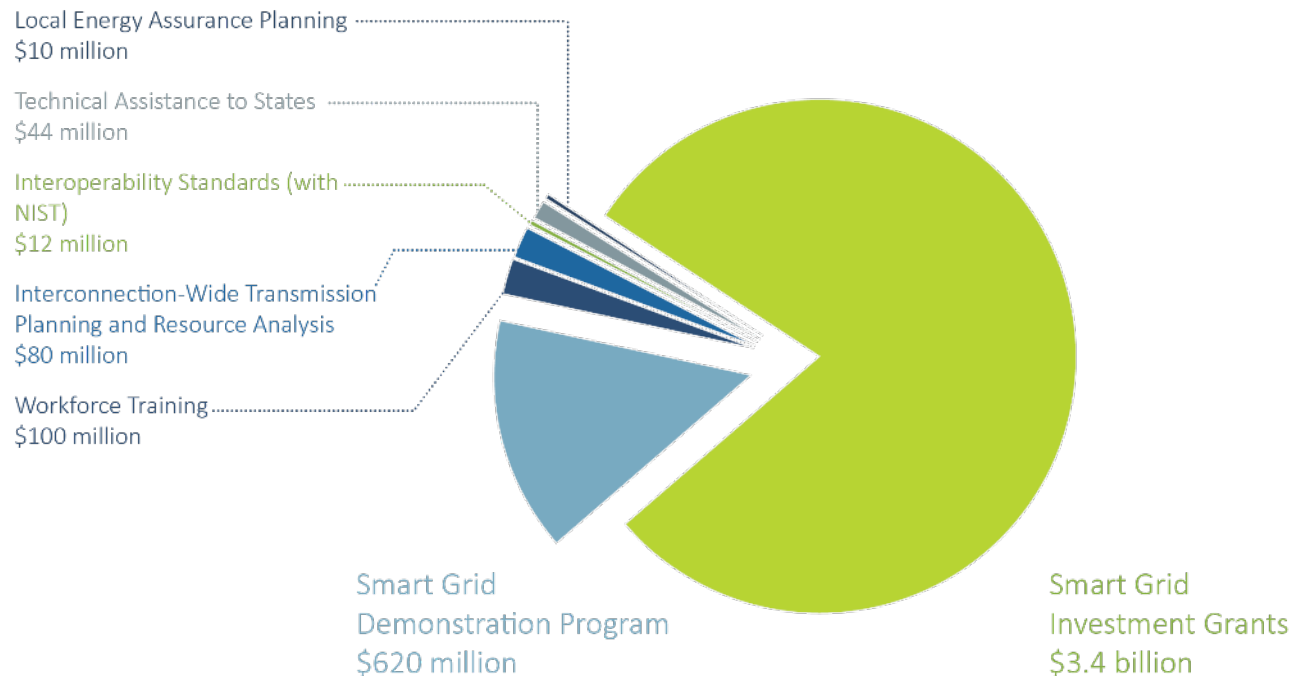
## Document Contents

Smart Grid Investment Grant Program (SGIG)	<b>SGIG Program-Level Documents</b>
	<b>SGIG Reports on Technology Applications and Results</b> These documents cover the following areas: Advanced metering infrastructure for peak and overall energy reduction through customer based technologies and to improve the operational efficiencies of utilities <ol style="list-style-type: none"><li>1. Distribution automation technologies to improve reliability through the use of fault location, isolation and service restoration technology—such as automated feeder switches—and improve energy efficiency through the use of volt/VAR optimization techniques, including conservation voltage reduction</li><li>2. Synchrophasor and other technologies in transmission systems to improve reliability and efficiency (via improved operations and asset utilization)</li></ol>
	<b>Reports on Consumer Behavior Studies (CBS)</b> DOE-developed and recipient-developed reports on time-based rate and pricing pilots
Smart Grid Demonstration Program (SGDP)	<b>Regional Demonstration Projects</b>
	<b>Energy Storage Demonstration Projects</b>
Case Studies	<b>Project-Specific Documents from SGIG and SGDP Projects</b>


# Recovery Act Smart Grid Overview

In 2009, the U.S. Department of Energy (DOE) Office of Electricity Delivery and Energy Reliability (OE) received \$4.5 billion in funds to support grid modernization activities under the American Recovery and Reinvestment Act (ARRA, or Recovery Act). The Recovery Act was an economic stimulus package enacted by the 111<sup>th</sup> United States Congress in February 2009 and signed into law on February 17, 2009, by President Barack Obama.

Much of the funding was applied to activities articulated within Title XIII of the Energy Infrastructure and Security Act of 2007, which states grid modernization policies leading to a smarter grid. OE apportioned the funding among several programs:



Although these programs are managed by various offices within OE, the Advanced Grid Initiatives (AGI) Office is largely responsible for managing the Smart Grid Investment Grant Program (SGIG) and the Smart Grid Demonstration Program (SGDP), and for reporting information on progress, grid impacts, benefits, and lessons-learned. (DOE's National Energy Technology Laboratory is responsible for implementing the SGDP under AGI management.) Information on the project activities associated with these programs is conveyed through conferences, reports, case studies, and other documents produced by Recovery Act funding recipients and by DOE (including supporting contractors and national laboratories).

Much of this information is housed in a central repository located on  SMARTGRID.gov

# Smart Grid Investment Grant Program

The Smart Grid Investment Grant (SGIG) program is authorized by the EISA, Section 1306, as amended by the Recovery Act. The purpose of the grant program is to accelerate the modernization of the nation's electric transmission and distribution systems and promote investments in smart grid technologies, tools, and techniques that increase flexibility, functionality, interoperability, cybersecurity, situational awareness, and operational efficiency. The SGIG projects were selected through a merit-based, competitive solicitation by which successful projects were eligible to receive federal financial assistance for up to 50% of eligible costs. There are 99 SGIG projects with a total budget of about \$8 billion; the federal share is about \$3.4 billion. Project descriptions of these 5-year projects can be found on [SmartGrid.gov](http://SmartGrid.gov), in addition to the following documents (where links are provided).

## SGIG Program-Level Documents



**Smart Grid Investment Grant Progress Report 2013**



**Economic Impact of Recovery Act Investments in Smart Grid**



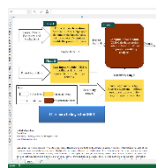
**SGIG Final Report**  
*Forthcoming - 1st QTR 2016*



**OMB Metrics Report**  
*Forthcoming - December 2015*



**DOE Smart Grid Computational Tool Users Guide 2.0**

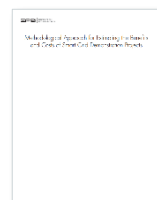


**Smart Grid Computational Tool**

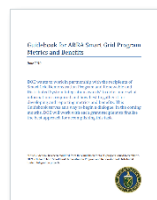


**Bridging the Gaps on Prepaid Utility Service**  
*Forthcoming - 1st QTR 2016*

## Analysis Guidance Documents



**Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects**  
EPRI 1020342, January 2010



**Guidebook for ARRA Smart Grid Program Metrics and Benefits**  
May 2010





















**Guidebook for Cost/Benefit Analysis of Smart Grid Demonstration Projects, Revision 1**  
EPRI 1025734, December 2012

## SGIG Reports on Technology Applications and Results

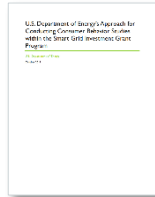
Technology-specific reports using results from SGIG projects have been published in the following topics areas:

- **AMI Demand Management** – Consumer-Based Demand Management Programs enabled by Advanced Metering Infrastructure (AMI)
- **AMI Operations** – AMI Applied to Operations
- **Distribution Automation** – Reliability Enhancements Achieved via Distribution Automation Technologies
- **Volt/VAR** – Improved Voltage and VAR Management
- **Transmission** – Transmission System Technology Advancements
- **Integration** – Integration of Renewable and Distributed Energy Resources

SGIG Reports on Technology Applications and Results	Date	AMI Demand Management	AMI Operations	Distribution Automation	Volt/VAR	Transmission	Integration
Published Documents							
 <b>Demand Reductions from the Application of Advanced Metering Infrastructure, Pricing Programs, and Customer-Based Systems - Initial Results</b>	Dec 2012	•					
 <b>Operations and Maintenance Savings from Advanced Metering Infrastructure - Initial Results</b>	Dec 2012		•				
 <b>Reliability Improvements from the Application of Distribution Automation Technologies - Initial Results</b>	Dec 2012			•			
 <b>Application of Automated Controls for Voltage and Reactive Power Management - Initial Results</b>	Dec 2012				•		
 <b>Synchrophasor Technologies and their Deployment in the Recovery Act Smart Grid Programs</b>	Aug 2013					•	
 <b>Model Validation Using Synchrophasor - NASPI Technical Workshop</b>	Oct 2013					•	
 <b>PMU Data Flows in North America</b>	Mar 2014					•	
 <b>Phasor Tools Visualization – NASPI Technical Workshop</b>	Jun 2014					•	
 <b>Synchrophasor Technology and Renewables Integration - NASPI Technical Workshop</b>	Jun 2014					•	

SGIG Reports on Technology Applications and Results	Date	AMI Demand Management	AMI Operations	Distribution Automation	Volt/VAR	Transmission	Integration
 <b>Use of IEC 61850-90-5 to Transmit Synchrophasor Information According to IEEE 73.118: NASPI Tutorial (October 16, 2012 – August 2014 Update)</b>	Aug 2014					•	
 <b>Customer Participation in the Smart Grid – Lessons Learned</b>	Sep 2014	•					
 <b>Municipal Utilities' Investment In Smart grid Technologies Improves Services and Lowers Costs</b>	Oct 2014	•	•	•			•
 <b>Factors Affecting PMU Installation Costs</b>	Oct 2014					•	
 <b>Smart Grid Investments Improve Grid Reliability, Resilience, and Storm Response</b>	Nov 2014			•			
 <b>Evaluating Electric Vehicle Charging Impacts and Customer Charging Behaviors - Experiences from Six Smart Grid Investment Grant Projects</b>	Dec 2014						•
<b>Fault Location, Isolation, and Service Restoration Technologies Reduce outage Impact and Duration</b>	Dec 2014			•			
Forthcoming Documents							
 <b>Advanced Metering Infrastructure and Customer Systems</b>	1 <sup>st</sup> QTR 2016	•					
 <b>Advancement of Synchrophasor Technology in Projects Funded through the American Recovery and Reinvestment Act of 2009</b>	Dec 2015					•	
 <b>Distribution Automation</b>	Jan 2016			•	•		

## Reports on Consumer Behavior Studies (CBS)



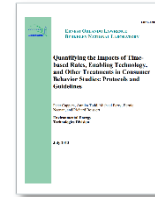
### U.S. Department of Energy's Approach for Conducting Consumer Behavior Studies within the Smart Grid Investment Grant Program

October 2011



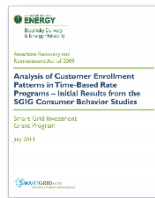
### Smart Grid Investment Grant Consumer Behavior Study Analysis: Summary of Utility Studies

June 2013



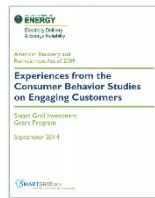
### Quantifying the Impacts of Time-Based Rates, Enabling Technology, and Other Treatments in Consumer Behavior Studies: Protocols and Guidelines

July 2013



### Analysis of Customer Enrollment Patterns in Time-Based Rate Programs - Initial Results from the SGIG Consumer Behavior

July 2013



### Experiences from the Consumer Behavior Studies on Engaging Customers

September 2014



### Interim Report on Customer Acceptance, Retention, and Response to Time-Based Rates from the Consumer Behavior Studies

June 2015



### Spillover Benefits from Time-Based Rates and Inter-Temporal Demand Impact

*Forthcoming – April 2016*



### Customer Biases toward Opt-Out (Default) Approaches to Enrollments in Time-Based Rate Programs

*Forthcoming – January 2016*



### Effects of Time-Based Rates on Vulnerable Customer Groups

*Forthcoming – February 2016*



### Relative Merits of Alternative Experimental Designs for Studies and Evaluations of Time-Based Rates


*Forthcoming – February 2016*























### Final Report on Consumer Behavior Studies Program Results

*Forthcoming – June 2016*

## Guidance Documents

See the **Consumer Behavior Section** on  for the complete set of ten Consumer Behavior Guidance Documents.

Participating Utilities	Evaluation Reports			
		Interim		Final
Central Vermont Public Service to “Green Mountain Power” – eEnergy Vermont		Nov 2013		Mar 2015
Detroit Edison – SmartCurrents Home Project		Jan 2014		Sep 2014
First Energy – Smart Grid Modernization Initiative		May 2013		Jun 2015
Lakeland Electric – Smart Metering Infrastructure Initiative		Feb 2015		Apr 2015
Marblehead Municipal Light Department – Residential Dynamic Pricing Pilot Project		May 2012		Jun 2013
Minnesota Power – AMI Behavioral Research		Mar 2014		Mar 2016
NV Energy – Nevada Dynamic Pricing Trial of the Advanced Services Delivery Project		Dec 2014		Mar 2016
Oklahoma Gas and Electric – Smart Study TOGETHER		Mar 2011		Aug 2012
Sacramento Municipal Utility District – SmartSacramento Project		Oct 2013		Sep 2014
Vermont Transco, LLC – eEnergy Vermont		Oct 2013		Jun 2015



# Smart Grid Demonstration Program

The Smart Grid Demonstration Program (SGDP) is authorized by EISA, Section 1304, as amended by the Recovery Act, to demonstrate how a suite of existing and emerging smart grid concepts can be innovatively applied and integrated to prove technical, operational, and business-model feasibility. The aim is to demonstrate new and more cost-effective smart grid technologies, tools, techniques, and system configurations that significantly improve on the ones commonly used today. SGDP projects were selected through a merit-based solicitation in which provides financial assistance of up to 50% of the project's cost. Note that SGDP projects are cooperative agreements, whereas the Smart Grid Investment Grant projects are grants.

Two types of smart grid projects were selected for the SGDP. One includes regional smart grid demonstrations to verify smart grid viability, quantify smart grid costs and benefits, and validate new smart grid business models at scales to promote replication. The second includes energy storage technologies such as batteries, flywheels, and compressed air energy storage systems for load shifting, ramping control, frequency regulation services, distributed applications, and the grid integration of renewable resources such as wind and solar power.

The program consists of 32 projects in the two areas: Smart Grid Regional Demonstrations (16 projects) and Energy Storage Demonstrations (16 projects). The total budget for the 32 projects is about \$1.6 billion; the federal share is about \$600 million.

The recipients of SGDP awards are required to submit interim and final Technology Performance Reports (TPRs) to DOE. Each TPR contains the following information:

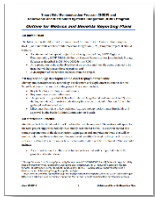
- An overview of the project including a list of objectives, system designs, schedules and milestones, and interactions with project stakeholders.
- Descriptions of the technologies and systems used in the project, including the sizes, types, and configurations of the storage module, power conversion devices, and balance of plant equipment.
- Descriptions of the methodologies and algorithms for estimating the physical and financial performance of the energy storage systems, their grid impacts, and the value of the benefits.
- Summaries of the results of the performance of the systems and technologies derived from lab tests, field tests, or grid-connected applications.
- Summaries of the results of the analysis of grid impacts and estimation of benefits.
- Summary of the major finding and conclusions including lessons learned and best practices.
- Summary of future plans and next steps with respect to additional testing, demonstration, or deployment.



## Regional Demonstration Projects

Smart Grid Regional Demonstration projects involve assessments of the integration of advanced technologies with existing power systems including those involving renewable and distributed energy systems and demand response programs. The technical and economic performance of these technologies are being evaluated for applications such as microgrids, automated distribution systems, advanced metering infrastructure, time-based rate programs, and plug-in electric vehicles.

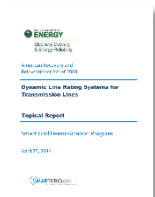
The recipients of SGDP awards for regional demonstrations are required, in most cases, to submit interim and final Technology Performance Reports according to the following guidance:



### Outline for SGDP Regional Demo Metrics and Benefits Reporting Plans

June 2010

## Program-Level SGDP Reports – Regional Demonstration



### Dynamic Line Rating Systems for Transmission Lines

April 2014



### Distributed Energy Resources Integration

*Forthcoming – 1<sup>st</sup> QTR 2016*



### Conservation Voltage Reduction

*Forthcoming – 1<sup>st</sup> QTR 2016*



### Microgrids

*Forthcoming – 1<sup>st</sup> QTR 2016*



### Transactive Energy Communications Systems

*Forthcoming – 1<sup>st</sup> QTR 2016*












### SGDP Interim Report
















*Forthcoming – 1<sup>st</sup> QTR 2016  
(many SGDP projects continue  
after this date)*

## NRECA Topical and Case-Based Technology Performance Reports

	<b>AMI-Based Load Research - KIUC Demonstration</b>	May 2014
	<b>Building Consumer Acceptance to Maximize the Value of Grid Modernization</b>	May 2014
	<b>Communications: The Smart Grid's Enabling Technology</b>	May 2014
	<b>Conservation Impact of Prepaid Metering Motivation and Incentives for Pre-Pay Systems</b>	May 2014
	<b>Costs and Benefits of Conservation Voltage Reduction: CVR Warrants Careful Examination</b>	May 2014
	<b>Costs and Benefits of Smart Feeder Switching: Quantifying the Operating Value of SFS</b>	May 2014
	<b>Delaware County Electric Cooperative: DR Capability and Predictability</b>	May 2014
	<b>Demand Response: Testing the Theoretical Basis for DR</b>	May 2014
	<b>Energy Storage-The Benefits of "Behind-the-Meter" Storage Adding Value with Ancillary Services</b>	May 2014
	<b>Multi-Tenant Meter Data Management: A Systems Approach to Hierarchical Value</b>	May 2014
	<b>Washington-St. Tammany Case Study Stress-Testing Designs Before Deployment</b>	May 2014

## Technology Performance Reports for Regional Demonstration Projects

Project Lead	Regional Demonstration Project Title	Technology Performance Reports	
		Interim	Final
<b>AEP Ohio</b>	gridSmart Demonstration Project	 <b>Mar 2013</b>	 <b>Jun 2014</b>
<b>Battelle Memorial Institute</b>	Pacific Northwest Smart Grid Demonstration Project	 <b>Jun 2015</b>	 Jun 2015
<b>Boeing Co</b>	Demonstrating a Cyber Secure, Scalable, Interoperable, and Cost-Effective Smart Selection for Optimizing Regional Transmission System Operation	 <b>Dec 2012</b>	
		 <b>Jun 2013</b>	 <b>Dec 2014</b>
		 <b>Nov 2013</b>	
<b>Center for Commercialization of Electric Technologies</b>	Technology Solutions for Wind Integration in ERCOT		 <b>Feb 2015</b>
		 <b>Sep 2013</b>	 (Appendix)
			 (Appendix)
<b>Consolidated Edison Company of NY</b>	Secure Interoperable Open Smart Grid Demonstration	 <b>Jul 2012</b>	 <b>Dec 2014</b>
			 (Appendices)
<b>Kansas City Power &amp; Light Co</b>	KCP&L Green Impact Zone Smart Grid Demonstration	 <b>Mar 2013</b>	 Apr 2015
		 <b>Dec 2013</b>	
<b>Long Island Power Authority</b>	Long Island Smart Energy Corridor	 <b>Jun 2013</b>	 <b>Apr 2015</b>
		 <b>Jul 2014</b>	
<b>LA Department of Water &amp; Power</b>	LA Department of Water & Power Smart Grid Regional Demonstration Project	 Jan 2015	 Sep 2016
<b>National Rural Electric Cooperative Association</b>	NRECA Smart Grid Demonstration Project	 <b>Apr 2013</b>	 <b>Mar 2015</b>

Project Lead	Regional Demonstration Project Title	Technology Performance Reports	
		Interim	Final
		 Nov 2013	
NSTAR Electric & Gas Corporation	NSTAR Automated Meter Reading-Based Dynamic Pricing	 Mar 2013	 Jun 2014
NSTAR Electric & Gas Corporation	NSTAR Urban Grid Monitoring and Renewables Integration	 Sep 2014	 Mar 2016
Oncor Electric Delivery Co	Dynamic Line Rating Project	 Dec 2011	 Aug 2013
Pecan Street Project	The Pecan Street Project Energy Internet Demonstration	 June 2014	 Feb 2015
New York Power Authority	Evaluation of Instrumentation and Dynamic Thermal Ratings for Overhead Lines	 Aug 2011	 Oct 2013
Southern California Edison	Irvine Smart Grid Demonstration	 Dec 2014	 Dec 2015
		 Jan 2015	
Waukesha Electric Systems/SuperPower	Fault Current Limiting Superconducting Transformer	N/A	 Dec 2016

## Energy Storage Demonstration Projects

Energy Storage Demonstration projects involve a variety of technologies including advanced batteries, flywheels, and underground compressed air systems. These projects are demonstrating a variety of size ranges and system configurations and their impacts on the grid. Technical and economic performance is being evaluated for a variety of applications including load shifting, ramping control, frequency regulation services, voltage smoothing, distributed energy, and the grid integration of renewable resources such as wind and solar power.

The recipients of SGDP awards for energy storage projects are required to submit interim and final Technology Performance Reports according to the following guidance:



### Outline for SGDP Energy Storage Metrics and Benefits Reporting Plans

August 2010

## Program-Level SGDP Reports – Energy Storage

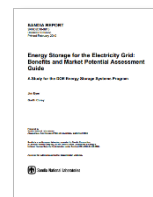


### DOE Energy Storage Computational Tool User Guide 1.2

July 2012



### Energy Storage Computational Tool



### Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Sandia Report (SAND2010-0815)

February 2010



### Methodology to Determine the Technical Performance and Value Proposition for Grid-Scale Energy Storage Systems


December 2012



### ARRA Energy Storage Demonstration Projects: Lessons Learned and Recommendations

June 2015







## Technology Performance Reports for Energy Storage Projects

Project Lead	Energy Storage Project Title	Technology Performance Reports			
			Interim		Final
<b>Amber Kinetics</b>	Demonstration of a Flywheel System for Low Cost, Bulk Energy Storage		<b>Apr 2012</b>		Dec 2015
<b>Aquion Energy</b>	Demonstration of Sodium-ion Battery for Grid-level Applications		N/A		<b>Aug 2012</b>
<b>Hazle Spindle</b>	Beacon Power 20MW Flywheel Frequency Regulation Plant		<b>Jun 2015</b>		Dec 2015
<b>City of Painesville</b>	Painesville Municipal Power Vanadium Redox Battery Demonstration Program		<b>Feb 2015</b>		Apr 2016
<b>Detroit Edison Company</b>	Detroit Edison's Advanced Implementation of A123s Community Energy Storage Systems for Grid Support		N/A		Dec 2015
<b>Duke Energy Business Services</b>	Notrees Wind Storage		<b>Nov 2013</b>		Mar 2016
<b>East Penn Manufacturing</b>	Grid-Scale Energy Storage Demonstration for Ancillary Services Using the UltraBattery Technology		<b>Jan 2014</b>		Aug 2015
<b>Ktech Inc.</b>	Flow Battery Solution for Smart Grid Renewable Energy Applications		N/A		Jun 2015
<b>New York State Electric &amp; Gas Corporation</b>	Advanced CAES Demonstration 150 MW Plant Using an Existing Salt Cavern		N/A		<b>Sep 2012</b>
<b>Pacific Gas &amp; Electric</b>	Advanced Underground CAES Demonstration Project Using a Saline Porous Rock Formation as the Storage Reservoir		Mar 2017 (annual)		Mar 2023
<b>VionX Energy</b>	Distributed Energy Storage System Demonstration		Feb 2017		Apr 2018
<b>Primus Power Corporation</b>	Wind Firming Energy Farm		Dec 2016		Mar 2018
<b>Public Service Company of New Mexico</b>	PV Plus Battery for Simultaneous Voltage Smoothing and Peak Shifting		<b>Sep 2012</b>		<b>Apr 2014</b>
<b>Seo Inc.</b>	Solid State Batteries for Grid-Scale Energy Storage		N/A		<b>Apr 2015</b>
<b>Southern California Edison</b>	Tehachapi Wind Energy Storage Project		<b>Apr 2015</b>		Aug 2016
<b>SustainX Inc.</b>	Demonstration of Isothermal Compressed Air Energy Storage to Support Renewable Energy Production		<b>Jul 2014</b>		<b>Apr 2015</b>














# Case Studies














Project-specific case studies, using results from both SGIG and SGDP projects, have been published in the following topics areas:














- **AMI Demand Management** – Consumer-Based Demand Management Programs enabled by Advanced Metering Infrastructure (AMI)
- **AMI Operations** - AMI Applied to Operations
- **Distribution Automation** – Reliability Enhancements Achieved via Distribution Automation Technologies
- **Volt/VAR** – Improved Voltage and VAR Management
- **Transmission** – Transmission System Technology Advancements
- **Integration** – Integration of Renewable and Distributed Energy Resources
- **Cyber Security** – Cyber Security, System Integration, and Communications Technology
- **Equipment Monitoring**
- **Workforce Development**

Case Studies	Performer	Date	AMI Demand Management	AMI Operations	Distribution Automation	Volt/VAR	Transmission	Integration	Cyber Security	Equipment Monitoring	Workforce Development
Published Documents											
 <b>A Smart Grid Strategy for Assuring Reliability of the Western Grid</b>	WECC	May-11					•				
 <b>Reducing Peak Demand to Defer Power Plant Construction in Oklahoma</b>	OG&E	May-11	•								
 <b>National Rural Electric Cooperative Association - Helping America's Electric Cooperatives Build a Smarter Grid to Streamline Operations and Improve Service</b>	NRECA	May-11							•		
 <b>A Smarter Electric Circuit: Electric Power Board of Chattanooga Makes the Switch</b>	EPB	May-11			•						
 <b>Bright Lights, Big City: A Smarter Grid in New York</b>	Con Edison	May-11			•	•				•	
 <b>Smart Meter Investments Support Rural Economy in Arkansas</b>	Woodruff	Jul-11	•	•							



Case Studies	Performer	Date	AMI Demand Management	AMI Operations	Distribution Automation	Volt/VAR	Transmission	Integration	Cyber Security	Equipment Monitoring	Workforce Development
 <b>Synchrophasor Technologies for a Better Grid</b>	NASPI	Jul-11	●	●			●				
 <b>Smarter Meters Help Customers Budget Electric Service Costs</b>	Tri-State	Sep-11									
 <b>At the Forefront of the Smart Grid: Empowering Consumers in Naperville, Illinois</b>	City of Naperville	Sep-11	●		●			●			
 <b>Workforce Training Case Study</b>	N/A	Sep-11									●
 <b>Agricultural Demand Response Program in California Helps Farmers Reduce Peak Electricity Usage, Operate More Efficiently Year-Round</b>	M2M Communications	Nov-11	●								
 <b>Vermont Pursues a Statewide Smart Grid Strategy</b>	eEnergy Vermont	Nov-11	●		●						●
 <b>Building a Smarter Distribution System in Pennsylvania</b>	PPL	Dec-11			●	●			●		●
 <b>A “Model-Centric” Approach to Smarter Electric Distribution Systems</b>	ORU	Dec-11			●				●		
 <b>Pacific Northwest - Battelle Smart Grid Demonstration Project 2012 Annual Report</b>	Battelle	Dec-11	●					●	●		
 <b>Glendale, California Municipal Invests in Smart Grid to Enhance Customer Services and Improve Operational Efficiencies</b>	GWP	Feb-12	●		●			●	●		●
 <b>CenterPoint Energy's Smart Grid Solutions Improve Operating Efficiency and Customer Participation</b>	CenterPoint	Feb-12	●	●	●						
 <b>Transforming Electricity Delivery in Florida</b>	TEC	Mar-12		●		●			●		
 <b>Critical Peak Pricing Lowers Peak Demands and Electric Bills in South Dakota and Minnesota</b>	SVE	May-12	●								

Case Studies	Performer	Date	AMI Demand Management	AMI Operations	Distribution Automation	Volt/VAR	Transmission	Integration	Cyber Security	Equipment Monitoring	Workforce Development
 <b>Smart Grid Solutions Strengthen Electric Reliability and Customer Services in Florida</b>	FPL	Jun-12	●		●	●			●	●	
 <b>Demand Response Defers Investment in New Power Plants in Oklahoma</b>	OG&E	Mar-13	●								
 <b>Smart Meter Investments Yield Positive Results in Maine</b>	CMP	Jan-14	●	●	●	●			●		
 <b>Smart Meter Investments Benefit Rural Customers in Three Southern States</b>	Tri-State	Feb-14	●	●					●		
 <b>Oncor's Pioneering Transmission Dynamic Line Rating Demonstration Lays Foundation for Follow-On Deployments</b>	Oncor	Apr-14					●				
 <b>Control Center and Data Management Improvements Modernize Bulk Power Operations in Georgia</b>	GSOC	Jul-14					●				
 <b>Using Smart Grid Technologies to Modernize Distribution Infrastructure in New York</b>	Con Edison	Jul-14			●					●	
 <b>Integrated Smart Grid Provides Wide Range of Benefits in Ohio and the Carolinas</b>	Duke Energy	Aug-14		●	●						
 <b>Automated Demand Response Benefits California Utilities and Commercial/Industrial Customers</b>	Honeywell	Aug-14	●								
 <b>New Forecasting Tools Enhance Wind Energy Integration in Idaho and Oregon</b>	IPC	Aug-14					●	●			
 <b>Energy Storage System Firms a Renewable Resource</b>	PNM	Oct-15						●			
 <b>Smart Grid Technologies Cut Emissions and Costs in Ohio</b>	AEP Ohio	Oct-15	●	●	●	●					
 <b>Demonstrating Coordinated Resources in the Pacific Northwest</b>	Battelle	Oct-15	●	●		●		●	●		

Case Studies	Performer	Date	AMI Demand Management	AMI Operations	Distribution Automation	Volt/VAR	Transmission	Integration	Cyber Security	Equipment Monitoring	Workforce Development
 <b>Energy Storage with Staying Power</b>	Aquion	Oct-15						●			
 <b>Spinning a Solution to Momentary Electric Grid Disturbances</b>	Hazle Spindle	Oct-15						●			
 <b>Improving Efficiency with Dynamic Line Ratings</b>	NYPA	Oct-15					●				
 <b>Making Electricity a Value Proposition for the Consumer</b>	Pecan St.	Oct-15	●								
 <b>Power to the People: Advanced Meter Reading Supports Consumer Programs</b>	NSTAR 292	Oct-15	●								
 <b>Improving Security in the Growing Smart Energy Corridor</b>	LIPA	Oct-15		●					●		
 <b>East Penn Manufacturing Delivers New Battery Technology for Electrical Grid Support</b>	East Penn	Oct-15						●			
 <b>Harnessing New Generation and Storage Technologies for the Grid</b>	CCET	Oct-15					●	●			
 <b>Renovating the Grid and Revitalizing a Neighborhood</b>	KCP&L	Oct-15	●	●	●			●			
 <b>Voltage and Power Optimization Saves Energy and Reduces Peak Power</b>	AEP, Battelle, KCP&L, NRECA	Oct-15				●					
Forthcoming Documents											
 <b>Optimizing the Smart Grid for Rural Electric Cooperatives</b>	NRECA	TBD							●		
 <b>Dispatching Large Scale Wind Power</b>	Duke Energy	TBD						●			
 <b>Improving Demand Response and Distributed Generation Integration</b>	Con Edison	TBD	●		●			●			